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DIEFFENBACH
ON
THE CURE OF STUTTERING.
TRANSLATED BY
JOSEPH TRAVERS.

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Diseases resulting from the irritation of Dentition.
On temporary irregularity and its prevention. Permanent irregularity.
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On the supposed occurrence of a third set of Teeth. &c. &c. &c.

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Injuries produced by Mechanical Violence.
On the loss of Enamel and wearing down of the Teeth.
On Salivary Calculus—Its formation and effects—Means of prevention and removal.
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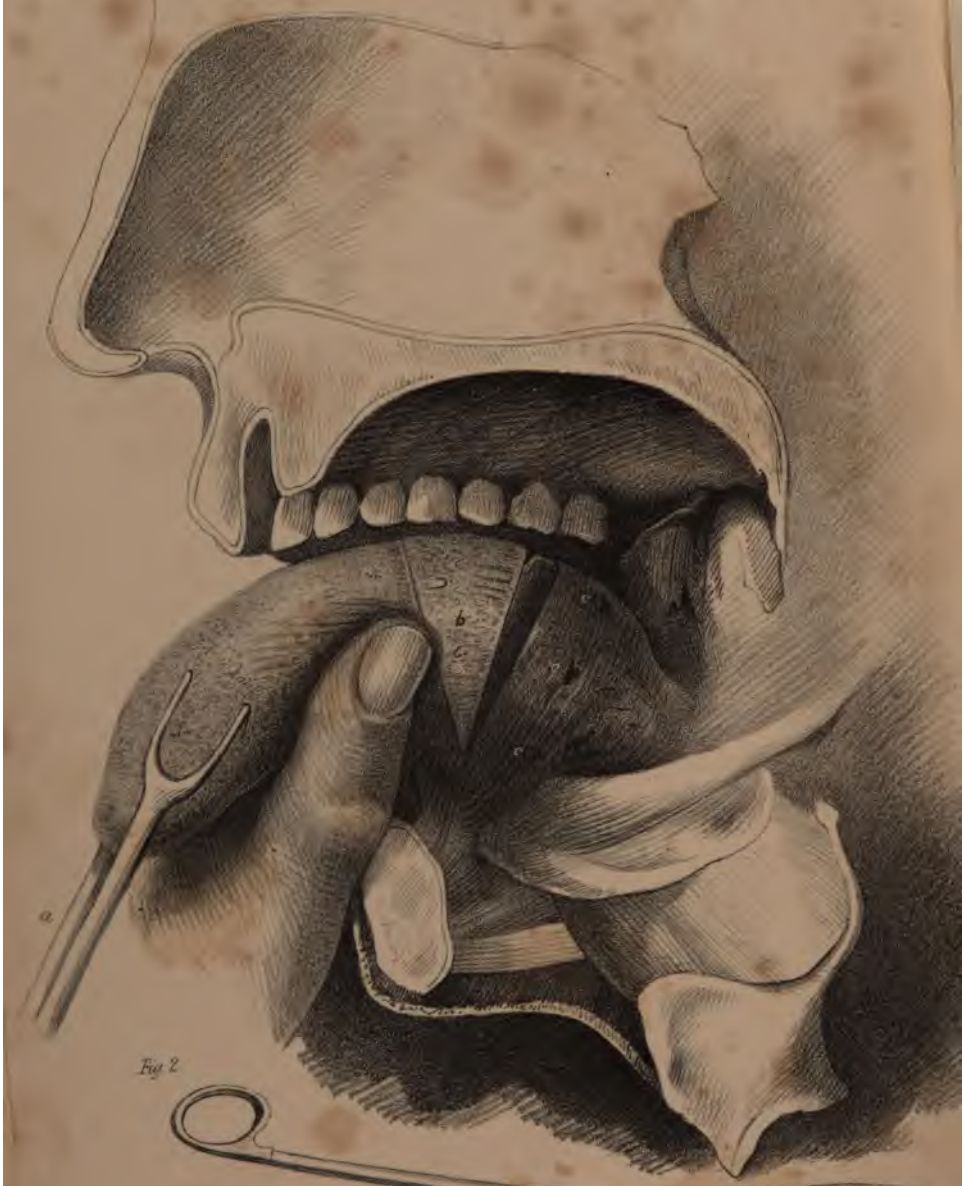

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MEMOIR

ON THE

RADICAL CURE OF STUTTERING,

BY A SURGICAL OPERATION.

BY J. F. DIEFFENBACH.

TRANSLATED FROM THE GERMAN,

BY

JOSEPH TRAVERS,

LATE HOUSE SURGEON TO ST. BARTHOLOMEW'S HOSPITAL.

LONDON:
SAMUEL HIGHLEY, 32, FLEET STREET.

1841.

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DEDICATED, BY PERMISSION,

TO

EDWARD STANLEY, ESQ. F.R.S.

SURGEON TO ST. BARTHOLOMEW'S HOSPITAL,

BY

HIS FRIEND AND LATE PUPIL,

THE TRANSLATOR.

TRANSLATOR'S PREFACE.

In the following Memoir M. Dieffenbach has laid before the world another proof of his genius as an operative Surgeon. Time alone can show how far this operation may be generally applicable; but the success of the first sixteen cases, and the very small proportion of untoward circumstances attending them, hold out the fairest prospect of its coming speedily into general use.

A daily attendance on M. Dieffenbach's lectures and practice has given me the opportunity of hearing his remarks on each case during its progress and treatment, and it has been my aim therefore to translate ideas rather than words; a mode approved by M. Dieffenbach himself, to whom the revision of this Translation has been submitted.

The occasional generalization of the long accounts of the peculiar mode of stuttering, in each individual case, has also received his personal approbation.

JOSEPH TRAVERS.

St. Swithin's Lane,
March 1st, 1841.

ON THE

RADICAL CURE OF STUTTERING.

My attention for some considerable time has been directed to the painful condition of the Stutterer or Stammerer. The striking inefficiency of all the means hitherto attempted of cure or palliation, the frequent relapse of those who thought themselves permanently relieved, the large majority of those who have resisted every effort of the most skilful instructors in the art of speaking, and the evident state of suffering with which persons thus afflicted have had through life to struggle, offered the strongest inducements to the prosecution of an inquiry into the possibility of a quick and radical cure. The idea lately suggested itself to me, that an incision carried completely through the root of the tongue, might possibly be useful, by producing an alteration in the condition of its nervous influence, allaying the spasm

of the Chordæ vocales, etc. The brilliant success of this new operation more than realized my most sanguine expectations.

In endeavouring to trace back this idea to its source, and to give it the form of a systematic conclusion, I am forcibly carried back to a case of Strabismus concomitans with Nystagmus, in which the patient signified his wish to undergo the operation, in a well-marked stutter. This awakened me to the possibility of an analogy existing between the two affections, which was shortly confirmed by the observation of many cases in which a spasmodic squint was attended by a greater or less degree of stuttering. I must here remark, that the momentary inability to pronounce a consonant, a syllable, or a word, was at times greater than at others — at times the want of dexterity in the mechanical use of the tongue under certain circumstances was greater or less.

Pursuing this analogy, and seeing in this disturbance of the organs of speech a dynamic influence, which threw the air passages, and their laryngeal aperture in particular, into a state of spasm, in which the tongue, the muscles of the face, and often the muscles of the throat, participated, I came to the conclusion, that the interruption of the stream of nervous influence, either forwards or backwards, in one of the implicated muscular structures might well be followed by an alteration in, and removal of, this abnormal condition, inasmuch as an almost invariably favourable result followed the division of the muscles

of the eye, in Nystagmus bulbi, in spasmodic Strabismus, or when I attempted a similar operation for spasmodic affections of the face. The transverse division of the whole muscular substance of the root of the tongue seemed to be, on this showing, at least worth the trial, and I felt as confident of the result in this instance, as I was of the efficacy of the division of muscular structures in other essentially spasmodic affections.

To guard myself against the charge of being prejudiced for any one particular method of operation, and to avert the self-reproach of having taken a limited view of the matter, I determined to perform a division of the root of the tongue in various ways, and under several modifications — always, however, adhering to the general principle of all but total division, as, from the interruption thus given to the morbid nervous influence I could alone hope for a favourable result.

I have now given a trial to the three following methods of operating: they have equally for their object total division of the root of the tongue.

I. The transverse horizontal division of the root of the tongue.

II. The subcutaneous transverse division, in which the mucous covering of the tongue is left inviolate.

III. The horizontal division, with excision of a wedge-shaped portion.

I was more sanguine as to the success of the latter

method than of the two preceding, as here some shortening of the tongue must necessarily ensue; and forasmuch as the base of the wedge-shaped slice is made from the dorsum of the tongue, elevation of the tip must take place. This method, then, mechanically assists that organ to assume the position insisted on by those teachers who have been most successful in ameliorating this defect. Still, as it inflicts a more severe wound than the simple division of the tongue, either with or without division of its mucous covering, I felt it imperative on me to put these apparently more simple operations also to the proof.

The apparatus requisite is very simple:—

A pair of Müzeux forcep-hooks;

An ordinary hare-lip forceps, with teeth;

Two retracting hooks, with a handle for the corners of the mouth;

A narrow and much-curved sharp-pointed bistoury; curved strong needles, with thick ligatures of fourfold silk; and a pair of needle-pliers.

For the sake of brevity I will relate the method of operating, together with the other particulars of each case.

The first operation, I performed on the 7th of January, 1841. I chose for this case the method by which a wedge-shaped portion is removed from the posterior part of the tongue; for, as I have remarked, I felt more confidence in this than in the other methods.

Frederick Doenau, a highly intelligent and talented boy of thirteen years of age, had stuttered from his earliest childhood, and to so painful an extent, that the defect was thought to be quite incurable. It varied, however, much in degree: when at the worst, he was unable even to produce a sound. He stuttered in Latin and French, as well as in his own language—sometimes on one set of words, and sometimes on others. The pronunciation of the sibilant letters (s, z, ss,) and of the palatals hard (g, k, ch, and x,) was attended with particular difficulty; and he made no distinction between the hard sounds, p, t, k, and the soft ones, b, d, g (German). He repeated the same letter often four times running; and when he whispered, he stuttered as much as when he spoke loud or shouted; often he could either not speak at all, or produced only half articulate sounds. The presence of a stranger invariably affected him in a manner most painful to behold. His face became distorted; the alæ of the nose worked convulsively; his lips moved quiveringly up and down; his eyelids were expanded into a wild and eager stare; the tongue was now stiff, now played convulsively within the mouth; and the muscles of the throat, larynx, and trachea were sympathetically affected. Thus, after terrible efforts, the boy gave utterance to a mangled and imperfect word;—now for a time was his speech free, and words chased one another with incredible velocity, till confusion ensued amidst the thronging sounds; and the same painful scene was

thus again and again renewed. The peculiar physical horror which constitutes a stutterer, and which is excited by the effort to speak, is very similar to that which gives rise to the excitement and spasm of the hydrophobic patient at the sight of water. This internal movement might, on that account, be called phonophobia.

The boy's mother caught eagerly at my offer to make an effort to cure him; accordingly, with the assistance of Drs. Holthoff and Hildebrandt, the operation was performed as follows: — The boy sat with his head leaned against the breast of an assistant; the tongue being protruded as far as possible, was grasped on its anterior half with the forceps of Müzeux, being thus compressed laterally, and drawn forwards by one assistant. The gentleman against whose breast the boy's head rested, retracted the angles of the mouth with a pair of blunt hooks. Grasping now the tongue as near to its root as possible, between the thumb and forefinger of the left hand, I passed the bistoury through it, and divided it completely from below upwards; a strong ligature passed through the posterior edge of the wound, served to fix it temporarily, and prevent too great a strain upon the slender band which alone connected the mass of the tongue to it; the anterior lip of the incision was now grasped, and laterally compressed between the modified hare-lip forceps, and a wedge-shaped slice excised out of the whole thickness of the tongue. It will be found more convenient to make

this second incision from above downward, and with a small straight knife. The posterior edge of the wound was now, by means of the before-mentioned ligature, and a sharp double hook, drawn so far forwards that the needles with the ligatures could be conveniently passed through it; six strong sutures served to bring the edges of the wound together, and to restrain the hemorrhage. To effect the latter object, they must include the whole depth of the wound within their loop. That the hemorrhage was considerable, may be imagined from the nature of the operation, which should not be attempted by all persons indiscriminately. As soon as the boy's mouth was washed out, I desired him to pronounce some of those words which he had before found especially difficult; he did so without stuttering or hesitation. The distortion of the face, however, continued, the patient was put to bed, and a cooling plan of treatment ordered. With the exception of a slight sympathetic febrile disturbance, the swelling of the tongue, that one might anticipate, and the consequent impeded deglutition, nothing remains to be noticed, so far as regards his recovery from the operation itself. His features, and his mouth especially, were still much distorted when he spoke, but the stutter had entirely ceased. On the fifth day I removed three of the sutures; during the next twenty-four hours the swelling of the tongue had visibly decreased, and I then removed the three remaining sutures. On the 7th day the wound was completely

healed, the back part of the tongue alone was very inconsiderably swelled, and the boy quite re-established. At this present time, not the slightest trace of stuttering remains, not the slightest vibration of the muscles of the face, not the most inconsiderable play of the lips. His speech is throughout clear, well-toned, even, and flowing. Neither inward emotions nor unexpected external impressions, produce the slightest hesitation; he can speak, read, and entertain himself, indifferently with friends or strangers.

On the tenth day after the operation, I had the honour to present him to his Excellency the Baron Humboldt, who testified the liveliest interest in the happy re-establishment of the boy.

Many physicians of this town can speak personally as to the perfect success of this case. Messrs. Schoenlein, Müller, Lichtenstein, Krause, Romberg, and Busse saw him, and the last-mentioned interrupted him whilst reading, by desiring him to repeat the word "Preobadschenskoy," which he did without the slightest hesitation. The members of the Berlin Med. Society, have also bestowed their attention on this interesting case.

The operations with excision of a portion of the tongue, which, encouraged by the successful issue of this case, I have since undertaken, have met with a similar success.

Frederick Kiel, son of a schoolmaster at Potsdam, sixteen years of age, tall, slender, and intelligent, had stuttered from the age of six years. This affection followed his recovery from a smart inflammatory affection of the lungs. He suffered from a similar attack on the lungs, after the interval of about a year. The impediment appeared from this time to be much increased.

He has nine brothers and sisters. The two eldest sisters do not stutter; the next brother stutters at times; the two next brothers also do not stutter; but the younger sister, a child of three years of age, stutters in a very aggravated manner. The father himself stuttered till in his sixth year, when he suddenly ceased to do so. In my patient, the pronunciation of those words in the formation of which the lips are employed, or the tip of the tongue approximated to the upper teeth, or to the roof of the palate, was attended with particular difficulty, as for example in the letters b, p, d, t; the sibilant sounds s, z, ss, &c.

He pronounced the palatal sounds, the German g, k, ch, by themselves well enough, but in the hurry of a sentence he stuttered over even them. The pronunciation of the vowels deserves particular notice. When he slowly and attentively repeated them, he was able to go through them without hesitation; this was the effect of education! When he did so hurriedly or inattentively, one distinctly heard the aspirate prefixed, with the stuttering repetition h, h, a—h, h, e—h, i, i, etc.

The same thing took place with those consonants of which the written sounds require a prefixed vowel. Besides abnormal articulation of isolated sounds, both as connected with the cavity of the mouth and the larynx, there were many curious circumstances attending the mode of expiration. During speech the stream of air was often driven out involuntarily from the lungs, without assisting in the production of any tone. The cause of this appears to be, that the organs in the mouth which are destined to shape the rude sound produced in the larynx, and in particular those muscles of the tongue which are connected with the larynx, are prevented by a species of involuntary contraction from performing the motions necessary to distinct articulation, and thus the undefined sound escapes. The patient, then, by a powerful exertion, raises the whole chest and diaphragm, places his tongue in the requisite position, and brings forth the at length articulate word. The whole appearance of this young man betrayed suffering and melancholy; at each attempt to speak, his thorax and trachea were convulsively agitated; his stuttering might be said to be of intermittent or of irregular type, increased by anything that caused him anxiety. With his brothers and sisters he often spoke with little difficulty, but the slightest strangeness increased the impediment, and the ready thought in vain sought words in which to express itself; certain muscular structures being rendered incapable, by a sudden spasm, of executing the impulse of the will. The

operation in this case took place on the 19th January, 1841, in the presence of Messrs. Jünkgen, Romberg, Baum, J. Siebold, Keil, Trettenbacher, Hauck, Bühring, and Hildebrandt. I followed nearly the same plan of operation as in the case before related, by which a portion of the tongue near the root was removed. The tongue being drawn forward with Müzeux forceps, a strong ligature was passed through it at its most posterior part, and then pushing the bistoury through the tongue, the incision was completed from below upwards. The anterior lip of the wound, as before, was held between the forceps, (Plate No. II,) and a wedge-shaped slice of three-fourths of an inch in breadth at its top taken away in the whole thickness of the tongue; the edges of the wound were brought together by means of six strong sutures; the bleeding was not inconsiderable, but it ceased after the application of the sutures. Immediately after the operation, I made the young man repeat a few words, which he did without any stutter whatever, with the *gêne* only that might be expected after an operation on the tongue.

Strict quiet was ordered for him, and frequent rinsing of the mouth. No particular constitutional disturbance followed the operation; and except the swelling of the tongue, the symptoms did not differ from a severe catarrhal inflammatory sore throat. He had some difficulty in deglutition, and his tongue was coated. On the third day after the operation he had already quitted his bed, and pronounced

single words without difficulty. On the fourth day the tongue was scarcely swollen at all; its motions were free, and the patient could already pronounce a short sentence; he neither grimaced nor stuttered. On the 5th day I drew out one suture, and the others in the course of the two following days. On the eighth day the wound was healed, and the patient completely cured of his former most painful defect. Many physicians who have seen him since that time, can speak as to the complete success of this operation.

The method employed in these two cases, viz. the excision of a wedge-shaped portion of the root of the tongue, may be thus modified by those less practised in operating: In performing the first incision, a portion of the superior border of the laterally compressed tongue may be left undivided, until a suture has been passed through the posterior edge of the wound, to prevent the possibility of its premature retraction, and the incision afterwards completed. The following operation accomplished neither more nor less than I expected from it.

SIMPLE TRANSVERSO-HORIZONTAL DIVISION OF THE ROOT OF THE TONGUE.

This method of operating I have only tried in one case. The case was one of much difficulty being complicated with an otherwise incompetent state of the tongue. The excision of a portion was here

perhaps more strongly indicated, were it only to have abridged the unusual length of that member.

Carl Stephen, thirteen years of age, of weakly appearance, and slender intellect, had been, since his second year, the subject of Strabismus concomitans. At six years of age he lost the faculty of speech, apparently in consequence of an apoplectic attack, and laboured under this deprivation for three months, during which time he gave utterance only to inarticulate sounds. By slow degrees, and with great difficulty, he learned to pronounce isolated words, and, up to the date of the operation, his speech was so imperfect, that he was unable to frequent the school. At the sight of a stranger his face expressed the most painful anxiety, the squint increased, and the eyes moved about wildly; every endeavour to speak was attended by hideous grimaces, his colour came and went, the muscles of the throat worked powerfully, and his head vibrated here and there, his lips quivered when speech should have commenced, and saliva flowed copiously from his mouth. He grimaced most over the labials, and the pronunciation of the word *vater*, in which the *v* and the *t* so quickly follow one another, was attended with considerable difficulty.

The tongue being fixed, as in the foregoing cases, and its root cut transversely through, six strong sutures were applied, which brought the wound effectually together. As in the preceding cases the

bleeding was considerable at the time, but completely stopped by the application of the sutures.

The stuttering disappeared for a short time immediately after the operation, and the contractions of the countenance were materially diminished ; single letters and even the letter *p* and the word *vater* were pronounced without difficulty. The after treatment was here of a cooling nature ; the reaction was but slight, and the swelling of the tongue unimportant ; the flow of saliva was, however, particularly distressing to the patient. On the fourth day three sutures were removed, the others on the fifth day ; and the boy was then, as far as the operation was concerned, completely established. I was assisted by Dr. Holthoff, and Messrs. Buehring and Hildebrandt. In this case the hoped for improvement in speech did not take place, but the grimaces are not so bad as before.

In the following case subcutaneous division of the root of the tongue was tried ; as I wished to ascertain its value, and its relative difficulty or ease of performance.

Hermann Hirschberg, of Berlin, seventeen years of age, painter, of slender make of body, and limited intelligence, had stuttered from his earliest childhood, to such a degree, that he was unable to avail himself of any public school instruction, and could only attain to the most superficial acquirements.

To enter into a minute description of the mode in which he stuttered would be superfluous; suffice it to say, that it was ordinarily almost impossible, and sometimes quite impossible to understand the young man. I myself hoped but little from an operation, and the triumphant result was, therefore, the more gratifying to me. I determined to try, in this case, the subcutaneous division of the tongue, not because I hoped to gain any material advantages by this method of operating, but because it seemed to me necessary to try the worth of this method before giving a preference to either one of the others. I thought it possible also, that the introduction of the sutures might be rendered easier, as the tongue would be unable to retract as after the total division. On the other hand, I doubted whether the blood might not collect in so considerable a subcutaneous wound, and thus prevent the application of a continued pressure; and also, I thought, that this method must be a less certain one, inasmuch as no shortening of the tongue could take place, a condition which seemed to me to be necessary to success; nevertheless, the result quite exceeded my expectations. Dr. Trettenbacher, and Messrs. Buehring and Hildebrandt, assisted me at this operation.

The tongue being drawn as much forward as possible, I pushed a curved bistoury through it, as near its root as I could, and cut through its whole muscular thickness, leaving the mucous membrane inviolate; on the withdrawal of the knife the open-

ing appeared only of the breadth of the blade. The substance of the organ was so completely cut through, that a slight additional pull with the forceps would probably have torn it off. The blood streamed from the apertures made by the knife as vehemently as from a large artery, whilst at the same time the cavity of the wound became exceedingly distended with the rapidly flowing blood. This cavity I sought to diminish by introducing a strong suture from behind forwards, through the tongue, and with other sutures I closed the openings made by the bistoury on each side, The succeeding day passed without any circumstances worthy of observation Deglutition, as may be supposed, was impeded ; but he managed to swallow some thick soup. His tongue was furred, and he had a slight accession of fever in the evening. Complete reunion soon took place in the deep parts of the wound; on the seventh day the swelling had disappeared, and on the eighth he left his room. He stuttered no more ; but some few particular words still give him a little difficulty, and he delivers himself of certain tones with a slight hesitation of manner. However beautiful the result of this operation, as having so ameliorated the highest degree of stuttering, still it is not so fully satisfactory as those cases in which a portion of the tongue was actually excised; and this subcutaneous method cannot be recommended as being at all easier of performance.

ON THE TREATMENT OF THE WOUND OF THE TONGUE.

Wounds of the tongue, united by suture, heal with great rapidity, provided only the edges are kept in strict contact. Forasmuch as deep wounds of the posterior part of the tongue are complicated with considerable hemorrhage, it becomes necessary that these sutures should not only hold the edges in contact, but by embracing within the circle of their loops the whole depth of the incision, act at the same time as a means of restraint on the hemorrhage, which would otherwise be dangerous. They must on this account be more tightly drawn than is usual in ordinary external wounds. Taking up the arteries singly would here interfere too materially with the process of union, and would be as highly inadmissible as in the operation for hare-lip. The union of the wound is for the most part complete on the third day, sometimes it is tolerably firm at the end of twenty-four hours; but as no disadvantage attends the presence of the ligatures at that period, and the wound might be torn asunder by the movements of the tongue, thus giving rise to dangerous hemorrhage, they should not be disturbed till the fourth day; one, two, or three, may then be removed according to circumstances. Should they come away easily, the remainder may be taken away on the fifth and sixth days; to leave them longer than their presence is actually required, might cause sup-

puration, or the formation of fistulous passages. Should the withdrawal of the first ligature be attended by the flow of even a few drops of blood, it is a sign that the plastic process has not made sufficient progress to allow of the removal of more—that the union is not as yet firm, and nothing further should be attempted that day.

The drawing out of the sutures should be performed with great care and without any force. The patient must thrust his tongue a little forward, the loose end of one of the ligatures being then seized between the forceps, it is to be gently drawn forward, till the loop of the ligature comes into view, which may then be cut through; the ligatures being removed, the mouth should be rinsed with luke-warm water. The process of cicatrization, as I have remarked, takes place quickly; the scar presents a smooth surface, which differs greatly from the covering of the tongue itself, giving it the appearance of having an elevated edge.

The sutures leave some slightly marked depressions, each pair of which is connected by a shallow furrow, grooved by the ligature. These disappear at a later period, unless the suture is allowed to remain till ulceration takes place. Longitudinal wounds of the tongue leave a less evident scar than transverse ones; the scar consequent on the present operation divides the superficies of the tongue into two very distinct portions. When a portion of the tongue is removed, that member ever afterwards looks as

though the tip and body of a small tongue were grafted into the root of a larger one; as might be naturally expected where so large a portion of a gradually tapering organ is removed. The scar serves to make this peculiarity still more evident. In consequence of the removal of a portion of the tongue, the posterior part with its large papillæ presents itself more anteriorly in the mouth than is usual.

The wound when healed after either of these methods of operation, affords to the patient the sensation of a hard resistant elevation, which, however, softens by degrees, and possibly at a later period disappears. The movements of the tongue are free in every direction, and in those cases where a portion is removed, the patient experiences a sensation of shortening, and the tip of the tongue seems to be approximated to the palate.

No permanent alteration takes place in the sense of taste, but for a few days it seems to be somewhat blunted.

It cannot be supposed that an operation on the tip of the tongue would prove of benefit to stutterers, as then no alteration or breaking off of the abnormal nervous influence is effected. The shortening of the tongue, by amputation of its tip, and the excision of a portion of the anterior parts have, as might à priori be expected, no influence in diminishing stuttering. The division of the frœnum I have certainly seen useful in some impediments of speech, but not in stuttering.

In this operation it is more difficult to prescribe for the individual modifications of each particular case, than in the operation for Strabismus, and it can never be performed by one who has not the temperament of an operator; the hæmorrhage must hold all others at a respectful distance. The extent and importance of the operation, the possible danger to life, or loss of the tongue, either through the want of skill in the assistants who may tear it off when so nearly separated, or through mortification or ulceration of its connecting isthmus; these are contingencies rationally to be feared, and which must be carefully weighed before-hand.

During the last few days I have again operated on six stutterers, and removed from them portions out of the root of the tongue. In all the stuttering is completely cured.

The total number of stutterers that I have relieved up to this time is sixteen, and those who are as yet under treatment appear to promise equally favourable results.

Professor Müller, who has been kind enough to examine the excised portion of the tongue, found that it consisted of a portion of the genio-glossus, some of the proper fibres of the tongue, and small portions of the stylo and hypo-glossus.

Amidst the prevailing rage for modifying operations, I foresee that my having described the three principal available methods, cannot fail to open to Surgeons a vast field for the discovery of modifica-

tions, and the creation of instruments. We shall have conical and oblique incisions, from the surface and under the skin! Actual and potential cautery! We shall have knives and scissars with improved curves, and a thousand variously fashioned forceps and hooks. They will set the blades at angles with the handles to allow of a better light falling into the mouth. Opportunity is likewise afforded to professional antiquarians to hunt after a name for this operation. To them I freely make over the right of baptism.

For the best researches into the nature of stuttering, we have to thank the following distinguished men in Germany, J. Frank, Burdach, Keil, Schulthess, Wolfgang von Kempelen, Chladni, T. Mueller, &c., in England, Arnott; in France, Magendie, Serres, Itard, Voisin, Hervez, Chegoin, Colombat, and Rullien:

DIEFFENBACH.

Berlin, 31*st. January*, 1841.

PLATE I.

FIG. 1.—Side View of the Tongue.

a. Müseux Forceps, used by M. Dieffenbach, by which the tongue is drawn forwards in the first step of the operation.

b. The wedge-shaped portion to be removed: the posterior or first incision already completed.

c, c, c. Situations of the Sutures.

FIG. 2.—Another form of Müseux Forceps, suggested by Mr. Weiss.

PLATE II.

FIG. 1.—An ordinary sharp-pointed bistoury.

FIG. 2.—The forceps used to compress the tongue laterally during the excision of the wedge-shaped portion.

FIG. 3 and 4.—The needles and ligatures.

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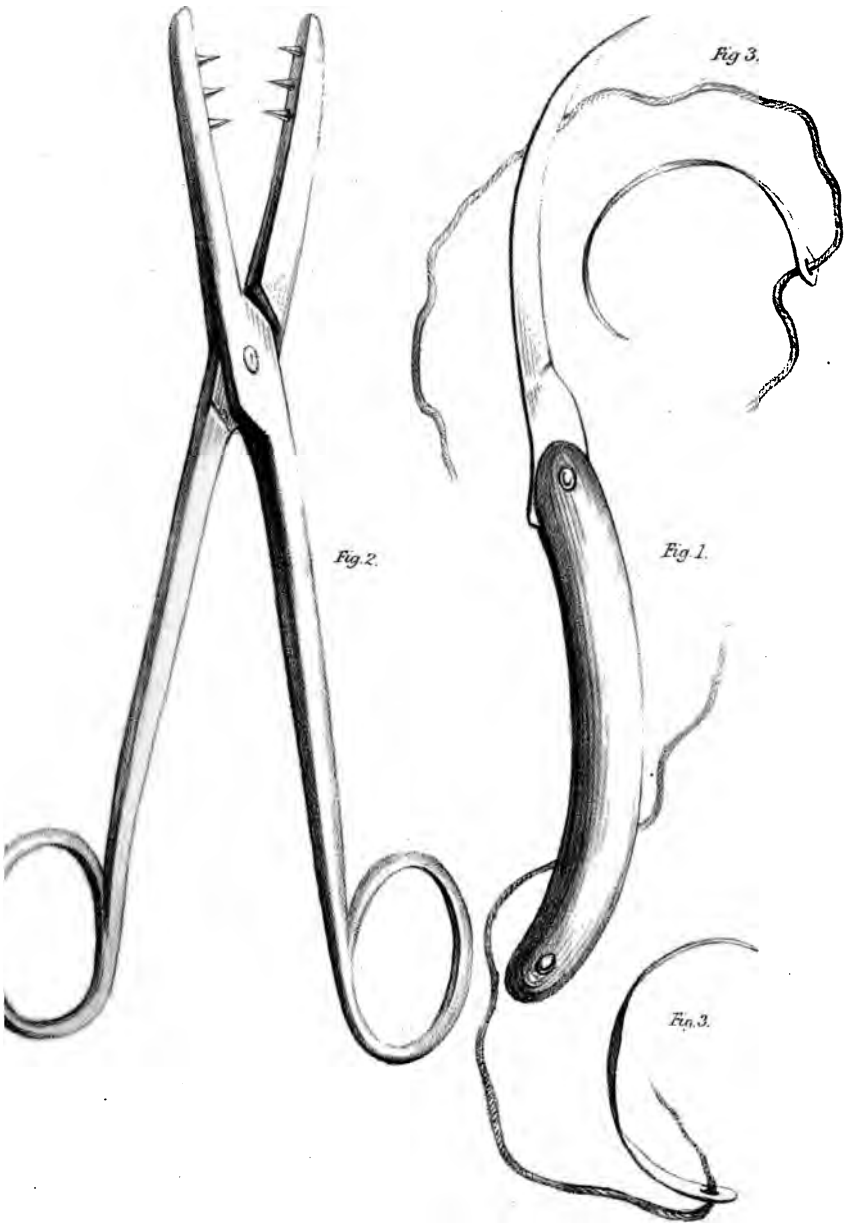

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Fig 1.

Fig 2.

Fig 3.

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FIG. 1.—A [illegible]

FIG. [illegible]—A [illegible]

FIG. [illegible]—A [illegible]

Fig. 1.

Fig. 2.

Pl.

PLATE III.

FIG. 1.—A Tongue, (in which a wedge slice of three-quarters inch broad at its base was removed) in the fourth week after the operation.

FIG. 2.—A Tongue, (where simple division of the root was performed) three weeks after the operation.

FIG. 3.—A Tongue, (in which the subcutaneous division was performed) three weeks after the operation.

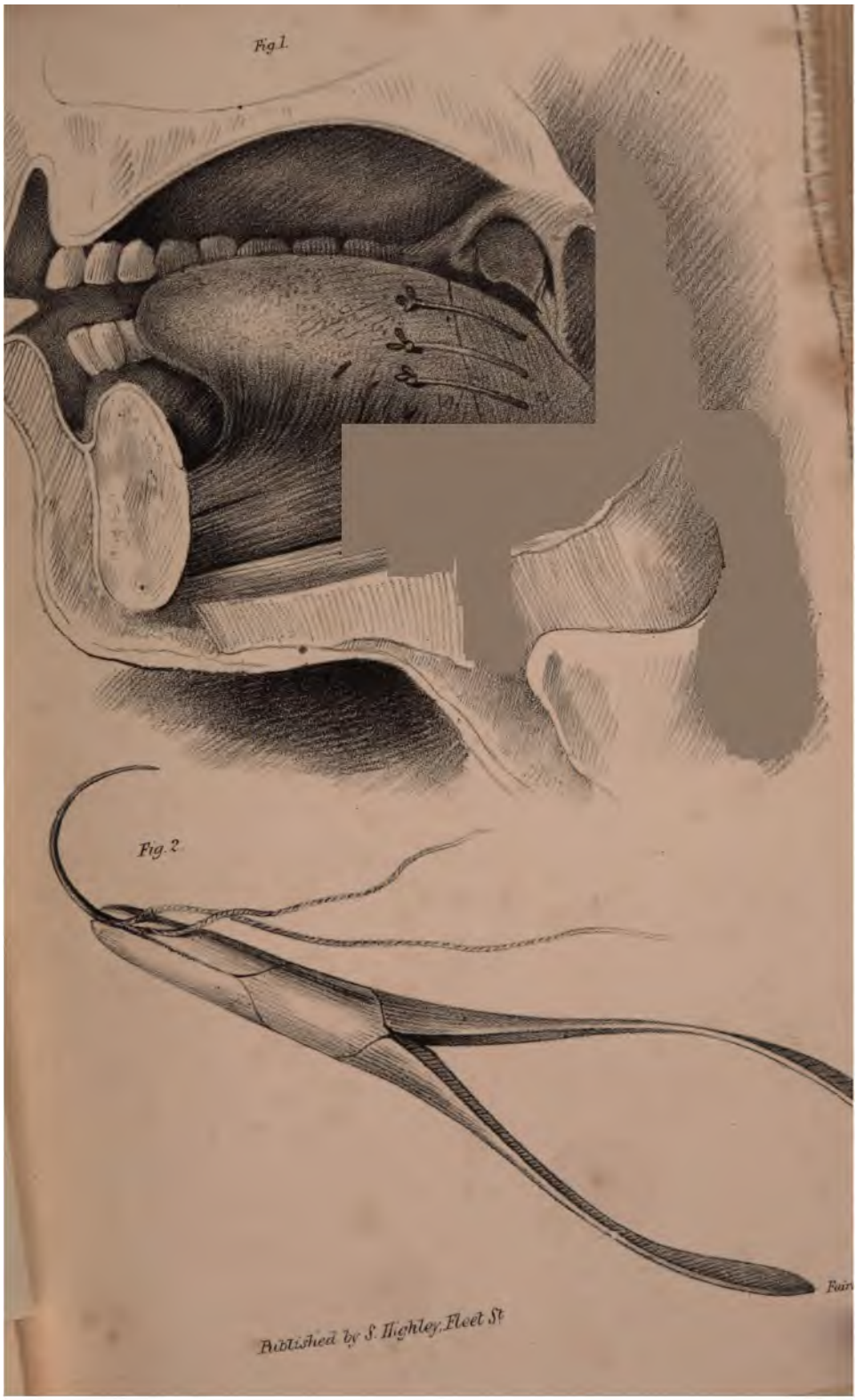
Fig. 1.
Fig. 2.
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